The American FERTILIZER

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The American FERTILIZER

Vol. 107 JULY 26, 1947 No. 2

Fertilizer Placement

By Dr. BENJAMIN WOLF, *Soil Chemist*

The G. L. F.-Seabrook Farms Raw Products Division, Seabrook Farms, Bridgeton, N. J.

MUCH of the value obtained from fertilizer is dependent upon where the fertilizer is placed. Sometimes wrong placement will be responsible for poor returns or actual crop losses from fertilizer use. Fertilizer may be placed in such a way that it is unavailable for plants because it is out of reach of roots (positionally unavailable) or it may be come fixed (chemically unavailable) or it may be brought in contact with growing roots to cause burning. The vast amount of work done on fertilizer placement is testimony to the fact that the importance of this is generally realized. However, this work has brought many claims and counter claims for one type of fertilizer placement over another.

It should be realized from the start that no one type of placement is best for all situations. One type may be suitable for one set of conditions but totally inadequate elsewhere. It is this reason that has been partly responsible for the many claims and counter claims. It is worthwhile to examine the conditions which influence the usefulness of certain types of placement and to determine the value of each type.

Several factors are involved in determining why one type of placement may be better than another. The kind and amount of fertilizer, the type of soil and its pH and organic matter content, the weather, and economics of handling fertilizer all bear on the problem.

The kind of fertilizer is important since the amount of burning of roots, and the leaching or fixation of fertilizer is dependent to a great extent upon what is in the fertilizer. Fertilizer containing only superphosphate, for example, can be applied with certain seeds whereas other ingredients can seriously decrease germination if so applied. In general, the readily soluble inorganic salts are capable of producing serious injury when placed close to seeds or root hairs. On the other hand, phosphate fertilizers are very definitely fixed under certain conditions and special precautions must be used to avoid undue fixation. There is much less need of periodic fertilizer application if fertilizer contains forms of nitrogen, such as organic nitrogen or ammonium phosphate, which are more resistant to leaching.

With small amounts of fertilizer, it may be better to use starter solutions or to band the fertilizer. With very large applications of fertilizer, it is generally not necessary to use starter solutions, nor is it practical to place the fertilizer in bands or under the row. Generally, as larger amounts of fertilizer are being used, there is a desirability to mix the fettilizer with as much soil as possible in order to promote a more vigorous root system. Very acid or other conditions which tend to fix large amounts of phosphorus may still make it necessary to band such fertilizer. However, if possible from a disease stand-

point, it is best to lime such soils to reduce the phosphate-fixing capacity and then apply fertilizer in such a way that it is mixed thoroughly with the soil.

The type of soil influences placement because leaching or fixation to a large extent is dependent upon soil type. The very sandy soils with considerable leaching and low buffer capacity make it necessary for periodic applications of fertilizer in order to conserve fertilizer and to reduce burning of sensitive plants. On such soils, the phosphorus is not fixed to any great extent and there is a desirability of plowing under all the phosphorus before planting the crop. However, usually nitrogen and potash are readily leached and they need to be applied in amounts and/or forms which will just supply the needs of the plants. On the other hand, the heavy soil with considerable holding capacity and reduced leaching can well be treated with large amounts of fertilizer. There is much less danger of burning on such soils and applications near the plant are much less serious. They do tend to fix large amounts of phosphorus and so require banding of one type or another.

Other Influencing Factors

The pH of the soil is important because of its influence on the fixation of phosphorus and the absorption of nutrients. With low pH, it becomes more important to band phosphorus and to apply more fertilizer. With more suitable pH values, the mixing of fertilizer with the large quantities of soil becomes a possibility. Soil of satisfactory pH values to considerable depths can make better use of plowed-under fertilizer.

The organic matter in the soil is important to consider in placement since it helps to reduce fixation of phosphorus even at fairly low pH values and is an important contributor to holding and buffering capacity. With large amounts of organic matter, there is much less need of banding fertilizer and there is less danger of burning from fertilizer salts. A soil rich in organic matter is, therefore, more flexible as far as type of fertilizer placement is concerned.

The weather, either as a leaching agent or fixing agent of certain fertilizers, must be considered in placement of fertilizer. Its effects, of course, are modified by soil type and organic matter content of the soil. In regions of high rainfall, periodic applications of fertilizer, especially on the lighter soils, are called for. On the other hand, there is much less danger of fertilizer burning in such areas. In regions of low rainfall, considerable potash may be fixed, requiring additional supplies.

As in any other activity, the economics of fertilizer placement is an important factor to consider. A method of placement may be satisfactory from the standpoint of plant growth but, if it is expensive, it may be ruled out. In other words, it may be worthwhile to use a method that wastes some fertilizer but is very cheap. Applying fertilizer in bands behind the plow furrow is considered to be very useful. However, it is an expensive way of applying fertilizer to crops since it slows the very important farm operation of plowing. Applying fertilizer before plowing is a relatively cheap operation and would have an advantage over drawing fertilizer equipment over plowed ground as is the case for fertilizer after plowing. Applying fertilizer to the cover crop enables farmers in some areas to purchase cheaper fertilizer (discounts due to season). Getting a 5 per cent discount on fertilizer would give this type of placement an advantage even if an additional 5 per cent of the fertilizer was lost by leaching. Also, such fertilizer can be applied during slack periods. The returns of certain crops are high enough to warrant use of the most expensive method or combination of methods of fertilizer placement since small gains in yield will pay for any extra cost. With many other crops, the returns are so low as to require the cheapest method of application that will give fair yields.

In light of this discussion, let us examine the different methods and state the advantages or disadvantages of each.

Six Methods of Application

There are about six general ways in which fertilizer may be applied.

1. *With the seed or plant.* This practice, used generally with very small amounts of fertilizer in solution as a starter, is useful in soils of poor fertility. The soluble phosphorus included supplies a special boost on acid soils. Wherever the pH is satisfactory and fertility level high, there is generally no need for such starter applications.

Larger amounts of fertilizer, with the exception of straight superphosphate, included along with the seed is usually a poor practice that will generally result in decreased stands and poorer yields.

2. *Under the row.* Wherever fertilizer is placed under the row so that germinating seedlings or transplants can come in contact with the fertilizer, there is danger of fertilizer

(Continued on page 28)

The Activities of the National Fertilizer Association

By WELLER NOBLE

Chairman of the Board of Directors, The National Fertilizer Association

(Continued from the issue of July 12, 1947)

The scope of our educational effort and dissemination of data has been so extensive, I can touch on only a few of the highlights.

The Fertilizer Review, containing educational and factual data, is now sent to a mailing list of 30,000. Each issue is sent to all members of Congress, governors of the States, 2,400 agricultural college workers, 3,300 county agricultural agents, more than 8,000 vocational agriculture instructors, and over 4,800 members of the press, farm journals, and newspapers, besides members of the Association. Since its inception 3,861,000 copies have been distributed. During the same period, over three million copies of *The Fertilizer News* have been sent to members of the Fertilizer Industry. Our most recent publications, *Agronomic Notes* and *Pasture Notes*, are receiving wide circulation. Educational articles from all of these publications have been rather generously reprinted in agricultural journals and newspapers reaching millions of readers, thereby serving a most useful purpose.

In the early days of the Association a set of wall charts was prepared entitled "Fertilizer To Keep More Livestock." There were 10,000 of these sets distributed to vocational schools, County Agents, and others. Many of these charts were still in use in school rooms in 1938 when a second set of 20 display wall charts of more comprehensive scope entitled "Fertilizers and Good Farming" was issued. Some 12,000 of these sets were distributed to vocational schools and County Agents. With each set of charts an attractive pamphlet was sent, designed to accompany the charts.

We have had numerous reports that these pamphlets in many instances were used as text-books.

The Association made its first motion picture in 1928, entitled *He Profits Most.* This film was shown in motion picture theaters and vocational schools wherever projectors were available. In 1939 an all-color motion picture titled *Green Acres* was started. This was the first commercial agricultural all-colored 16 mm. motion picture produced. It was followed by another motion picture, *Putting Plant Food to Work;* still another, *Life of the Soil;* and the most recent production is titled *Hunger Signs.* These pictures have been shown in our 48 States, Canada, England, Sweden, France, Africa, Australia, New Zealand, Argentina, Mexico, and Italy; in all, to in excess of 21,000 audiences including 1,500,000 persons—mostly to those in rural areas, interested in agriculture. Vocational schools, County Agents, and Extension specialitss are those to whom most of the films have been loaned. We have a total of 180 copies of motion picture films in circulation.

Agricultural colleges and soil conservation services have on deposit in their libraries 63 copies of our motion pictures. These films are listed in their catalogs and circulated by them, and acceptance by these institutions is in the nature of an endorsement of the films. We have sold 26 copies of our films; three went to England, three to South Africa, one to Argentina, three to Canada, one to France, three to Mexico, and others were sold in the United States, some to the United States Department of Agriculture, which bought copies of these films to circulate in the various States under their supervision. All orders for films were unsolicited.

The Association has issued 389 pamphlets covering practically every phase of agriculture. It is estimated that in excess of ten million copies of these pamphlets have been issued. Usually they are sent on request and consequently were placed in the hands of interested people. Probably one-quarter of these pamphlets were placed in vocational schools where they were used by students year after year.

The National Fertilizer Association was requested by State Agricultural Experiment Stations to act as a depository for Kodachrome slides showing nutrient deficiency symptoms.

Many of these slides were photographs taken by the Association staff, but a much larger number were loaned to the slide library. The library now has 250 slides and 10,000 copies have been distributed to agricultural workers for teaching purposes. These slides effectively tell the need for fertilizers. Through this media it is estimated that we have reached more than one million students and farmers since 1941.

Hunger Signs in Crops

Hunger Signs in Crops is a book of 340 pages, with 79 color plates and 95 half-tone illustrations, published jointly by the American Society of Agronomy and The National Fertilizer Association. It is the only book describing the nutrient deficiencies of a large number of crops. More than 22,000 copies have been sold at less than cost, as the Association assumed part of the cost of publication, and a third printing of 5,000 additional copies has been ordered. Practically every college worker in the country, interested in agronomy and horticulture, has a personal copy. It probably has stimulated more experimental investigation than any other book recently published. A number of agricultural colleges are using it as a text-book, among these North Carolina, New Jersey and Florida. The Veterans Agricultural Training classes are ordering large numbers for instruction purposes. A great many copies have been sent to foreign countries. Without the work of the Association in arranging to have the chapters written and financing the publication, it could not have been published. Pamphlets, Kodachrome slides, motion pictures and fertilizer wall-charts all carry the story of fertilizer usage to vocational agricultural high school students, County Agents, and farm organizations, and, in my opinion, are most effective in carrying the fertilizer story to the farmer of today and especially the farmer of tomorrow.

Survey of Fertilizer Practice

The importance of our Association was clearly demonstrated during World War II in the War Emergency. In 1940 the U. S. Department of Agriculture, foreseeing the emergency developing as to food supplies, undertook to establish goals and determine what acreages of various crops should be planted, and where. It was only natural that government officials should call upon our Association for assistance. Realizing that the data contained in our files would be of invaluable assistance in every phase of food planning, two members of The National Fertilizer Association staff were invited to sit with the Crop Production Goals Committee appointed for this purpose.

It was found at the first meeting that almost every member of this committee had before him a copy of *American Fertilizer Practice—Second Survey*, a publication of The National Fertilizer Association, and this survey served as the basis for recommendations of most of those present who reported for individual crops.

From the data reported in this survey came many of the decisions as to crop goals and fertilizer use that were carried out in the form of orders issued by the various agencies charged with the duties of obtaining maximum food production. At the request of officials of the U. S. Department of Agriculture, the third survey was undertaken by The National Fertilizer Association under war conditions in 1944. This was only another activity of our Association which assisted materially in maintaining a maximum production.

It is interesting to note that the three "Fertilizer Practices Surveys" made in 1929, 1938, and 1944 are the result of statements of more than 111,000 farmers interviewed by some member of the Fertilizer Industry, to ascertain the facts which were developed.

During the war, great difficulty was encountered by many manufacturers in obtaining priorities for maintenance and repair parts and materials. Members of the Washington staff were often very helpful to our members in advising them of the exact routine and procedure necessary to obtain priorities and were also able to expedite issuance of the necessary authority for purchase, by a close follow-up of the proper application.

Cooperation with Government Agencies

Still another war activity was the publication of 56 issues in all of *Fertilizer War Notes*. In these issues our Industry was advised promptly of all possible pertinent information regarding regulations and emergency orders as they were issued by the various war agencies, such as WPB, OPA, and WFA, or their predecessors or successors. These publications also were sent to a great number of agricultural workers so that they might also be informed concerning regulations governing our Industry.

Our Association also served as an information bureau for war agency officials dealing with fertilizer and food production problems. This was of immeasurable assistance, particularly to those who were summoned to Wash-

Changes in Grade List for North Carolina Recommended

An increase in fertilizer production next year was predicted in Raleigh on July 1st at a meeting of farmers and fertilizer manufacturers who recommended adoption of a list of 25 grades of mixed fertilizers to be registered for sale in North Carolina during the ensuing fiscal year.

Only two changes were made in the grade list in effect during the past year. The group, meeting for a public hearing called by Assistant State Agriculture Commissioner D. S. Coltrane, recommended that a new grade, 10-6-4, be added to the list, and that grade 10-0-10 be eliminated.

The total number of 25 recommended grades is the same as last year's total. The recommendations will be submitted to the Board of Agriculture for approval. Pending the board's action, the old grade list will remain in effect. No change is contemplated in the grades of tobacco fertilizers.

The proposed grade list was presented by Dr. Ralph Cummings, head of the N. C. State College Agronomy Department and assistant director of the State Experiment Station. He submitted a list of 26 grades, including 6-8-10, which was not accepted.

The tentative grade list follows:

For tobacco only, 2-10-6; 3-8-5; 3-9-6; 4-9-3; 6-9-3; and 5-5-20 (top dresser).

For tobacco and general crops, 3-9-9.

For general crops, 0-12-12; 0-10-20; 0-9-27; 0-14-7; 2-12-12; 3-9-12; 3-12-6; 4-8-8; 4-10-6; 4-12-4; 4-12-8; 5-10-5; 6-6-12; 6-8-6; 7-7-7; 10-6-4; 14-0-14 (top dresser); and 10-0-30 (top dresser).

About 100 persons attended the hearing. Coltrane announced at the outset that North Carolina farmers purchased a record amount of fertilizer in the fiscal year closing at midnight June 30th, buying 1,667,820 tons as compared with the 1,544,780 tons purchased in the previous fiscal year. This was an increase of 123,040 tons, or about eight per cent.

Two plant food experts of the U. S. Department of Agriculture addressed the meeting. The extimate of higher fertilizer production next year was made by W. F. Watkins of the Fertilizer Division of the Production and Marketing Administration.

Watkins said the outlook for next year's supplies of vital materials used in fertilizer manufacture indicated increases of 10 per cent in nitrogen, five per cent in potash and 10 per cent in soluble phosphates. Supplies of nitrogen for fertilizer will increase from 757,000 tons used last year to about 825,000 tons in the ensuing year, he reported.

Production of sulphuric acid is above the war-time peak, Watkins said. He added that the nation needs more fertilizer plants and plant equipment, and he said transportation may be a bottleneck next year in fertilizer distribution. He also said the industry needs a year-round program of production and distribution to handle efficiently the 16 or 17 million tons of fertilizer supplied to farmers.

Another speaker was Dr. K. G. Clark of the Bureau of Plant Industry, who presented a technical talk on "Quality of Water Insoluble Nitrogen in Mixed Fertilizers."

Suggestions that the grade list of mixed fertilizers be reduced were made by Dr. S. F. Thornton of the Royster Guano Co., Ralph Douglass of the Smith-Douglass Co., and W. S. Bethune, Robeson County grange leader. Others, including Alonzo Edwards of Greene County, maintained that the recommended list was the result of continued research by North Carolina crop authorities and should be accepted in the form presented without major change.

Officials of Tobacco Associates, Inc., organized recently to promote exports of flue-cured tobacco, urged those present to encourage farmers to vote in the July 12th referendum on the proposal to assess farmers 10 cents per acre of tobacco, with the accrued money to be used in furthering the development of markets for tobacco. This appeal was made by E. Y. Floyd, secretary of Tobacco Associates, Inc., and Edwin Pate of Laurinburg, director representing fertilizer manufacturers.

Lion Oil Announces New Ammonium Nitrate Price

The Lion Oil Company has announced a price on ammonium nitrate of $48.50 per ton in 100 pound paper bags, f.o.b. plant, effective August 1st. The company is in process of shifting the finishing process on this material to their plant at El Dorado, Kansas. For the past months, the graining has been done at based plants in Doyline, Louisiana and Defense, Texas. With the completion of their new pelleting plant, the company will be able to raise the nitrogen guarantee from 32.5 per cent N to 33.5 per cent and to market the product in pellet form which will eliminate all fines and improve mechanical condition, storage qualities and drillability.

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Vol. 107 JULY 26, 1947 No. 2

Principal Articles in This Issue

IEFC Recommends Distribution of Nitrogen Fertilizers

Recommendations for the distribution in 1947–48 of 1,906,902 metric tons of nitrogen for fertilizer purposes among more than 100 claimant countries or areas have been forwarded to the governments concerned by the International Emergency Food Council.

The governments to which the recommendations are made submitted 1947–48 requirements for 2,740,000 metric tons of nitrogen. The supply available for distribution falls some 800,000 tons short of these requirements.

This severe shortage will be critically felt in every country using fertilizers, the Council stated in sending forward its recommendations. "Many countries with huge populations to feed are desperately in need of more nitrogenous fertilizers in order to increase their crop yields," the Council pointed out. "The acute shortage now existing comes about in spite of the fact that world production of nitrogen in 1947–48 will equal prewar. The need is now much greater than prewar since soil fertility lost during the war years must be restored and larger populations must be fed."

Of the 1,906,902 metric tons of nitrogen distributed by the 1947–48 recommendation, 1,266,332 tons is to be produced and used within national boundaries. To supplement this indigenous production, 640,570 tons is to be imported by claimants from the world pool.

Some countries depend entirely on imported nitrogen. Others produce some tonnage and import some. Five countries produce more nitrogen than they need in their own agriculture. Export-import supplies for the nations involved in the present distribution are to be made available by these five net nitrogen exporting countries in the following metric tonnages: Canada, 126,330; Chile, 278,400; United Kingdom, 43,910; Belgium, 68,400; Norway, 70,390. The United States is a net importer but owing to the nature of world trade usually exports some nitrogen and plans to export 52,600 metric tons in 1947–48.

Not included in the distribution recommended at this time are the Allied occupation zones of Germany, Japan, and South Korea and some claimant countries which have not yet provided sufficient data for use in considering their requirements. The Council said that a later recommendation will deal with requirements and suggested distribution among these areas.

In forwarding the recommendations the Council noted that the estimates of probable production for 1947–48 used were probably conservative. This course was taken because of the experience in 1946–47. Then more liberal estimates of production were used at the beginning of the year. Later when production did not reach the estimated volume a number of claimants were unable to obtain as much as was recommended for them. As a result of the conservative estimates used in making the 1947–48 recommendations it is possible that larger export supplies may become available later. If this occurs there will be changes in the recommended distribution. However, it is not expected at present that any additions to the world tonnage available will be very large.

Nitrogenous fertilizers are contracted for well in advance and the contracts for the 1947–48 deliveries will normally be concluded at an early date.

May Sulphate of Ammonia

There was little change in the May production figures for by-product sulphate of ammonia, as compiled by the U. S. Bureau of Mines. The output of 67,649 tons was only 4 per cent higher than in April and is accounted for by the longer month. For the first five months of the year, however, production showed a gain of more than 50 per cent over the same period of 1946. Shipment during May came to about the same figure as production, and consequently stocks on hand at the end of the month remained at about 19,000 tons.

	Sulphate of Ammonia Tons	Ammonia Liquor Tons (NH_3)
Production		
May, 1947.....	67,649	2,394
April, 1947.....	65,000	2,375
May, 1946.....	31,359	1,466
Jan.-May, 1947.	329,670	11,687
Jan.-May, 1946.	211,867	9,523
Shipments		
May, 1947.....	67,867	2,178
April, 1947.....	77,684	2,276
May, 1946.....	30,553	1,377
Stocks on hand		
May 31, 1947..	18,921	852
April 30, 1947..	19,541	787
May 31, 1946..	15,949	510

La Fave Appointed St. Regis Plant Manager

Francis G. La Fave has been appointed manager of the St. Regis Paper Company's Watertown, N. Y., multiwall paper bag plant, according to Willard E. Hahn, manager of bag production.

Mr. La Fave was night superintendent of the bag plant for approximately one year prior to his promotion to manager. In his new capacity, he replaces Budd E. Simonton, who recently became bag plant manager at Oswego.

Mr. La Fave joined St. Regis in 1935 in the bag printing division at the Watertown plant. He has been affiliated with that plant ever since.

Bemis Bag Announces Changes in Executive Staff

C. W. Loomis, Manager of the Bemis Bro. Bag Company Memphis plant since 1931, has been transferred to St. Louis where he will assume important administrative duties at the General Offices of the Company.

F. C. Chenault, Bemis Sales Manager at Memphis, succeeds Mr. Loomis as Manager of the Memphis plant of the Company. He will assume his new duties on July 1st. Mr. Chenault, a native of Tennessee, is widely known throughout the southern flour and feed industries and has been with the Bemis Company for over 30 years.

R. R. Duff, now in the Market Research Department in the Bemis Company's General Offices in St. Louis, will succeed Mr. Chenault as Sales Manager at the Memphis plant. Mr. Duff has been a member of the Bemis organization since 1932. During the war years he was on leave from the company and served in Washington in the War Foods Administration and in other governmental agencies.

Obituary

A. Elmer Reed

A. Elmer Reed of Tennent, N. J. died on July 5th, at 70 years of age. He was one of the founders of the fertilizer manufacturing firm of Reed & Perrine in 1916. When the firm was incorporated last January 1st, Mr. Reed was elected president.

May Tag Sales

Fertilizer tax tag sales in 16 States for May, based on reports of State control officials to The National Fertilizer Association, reached a new all-time high. Tag sales for May, totaling 644,000 equivalent short tons, were 24 per cent higher than the 520,000 tons reported for last May and 34 per cent higher than for May 1945.

In the 11 Southern States tag sales for May amounted to 505,000 tons, an increase of 25 per cent over last May. Seven of the 11 States reported increases, ranging from 2 per cent for South Carolina to over 400 per cent for Oklahoma, over last May. The remaining four Southern States showed decreases from the preceding May, Florida being the only one of these States with a noticeable decline.

May tag sales for the five Midwestern States amounted to 138,000 tons, compared with 115,000 tons for a year ago and 90,000 tons for May 1945. Compared with a year ago, May sales were higher for four of the States, with Missouri and Kansas recording the greatest increases. Sales in Illinois were 8 per cent lower than for a year ago.

Tag sales for January-May of this year amounted to 5,378,000 tons; this represented a decrease of 5 per cent from the same period last year but an increase of 4 per cent over the first five months of 1945.

FERTILIZER TAX TAG SALES

COMPILED BY THE NATIONAL FERTILIZER ASSOCIATION

STATE	MAY				JANUARY–MAY		
	1947 TONS	1946 TONS	1945 TONS	% OF 1946	1947 TONS	1946 TONS	1945 TONS
Virginia	62,680	41,956	55,298	98	407,486	414,276	364,386
N. Carolina	99,618	51,701	81,478	92	1,065,210	1,152,031	1,123,387
S. Carolina	45,191	44,330	37,800	90	573,199	636,890	639,668
Georgia	71,117	50,734	34,745	98	846,530	867,998	852,430
Florida	66,300	83,563	71,513	84	381,510	456,713	401,925
Alabama	52,050	52,500	29,500	83	528,800	638,150	593,650
Tennessee	54,088	31,998	37,575	97	202,780	209,892	211,225
Arkansas	13,100	13,350	15,750	117	131,600	112,550	95,650
Louisiana	11,550	11,975	11,550	89	113,730	127,506	123,736
Texas	23,728	21,900	15,200	102	196,376	192,741	138,235
Oklahoma	6,002	1,100	300	176	44,292	25,098	14,962
Total South	505,424	405,107	390,709	93	4,491,513	4,833,845	4,561,254
In diana	52,043	50,214	33,466	111	281,572	252,954	177,914
Illinois	35,200	38,250	20,964	127	202,125	158,908	134,389
Kentucky	40,700	21,990	33,075	108	239,054	221,221	204,533
Missouri	8,480	3,960	2,870	85	127,757	150,142	85,887
Kansas	2,070	245	0	231	36,013	15,706	13,865
Total Midwest	138,493	114,659	90,375	111	886,521	798,832	616,588
Grand Total	643,917	519,766	481,084	95	5,378,034	5,632,677	5,177,842

FERTILIZER MATERIALS MARKET

NEW YORK

Contracts for 1947–1948 Season Now the Principal Interest of the Fertilizer Industry. Sulphate of Ammonia Prices Vary. More Phosphate Rock To Be Available for Domestic Use During Coming Year.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, July 21, 1947.

The customary summer doldrums in the fertilizer industry are conspicuous by their absence this year. The material producers are working at top speed to even keep within sight of the orders on their books, while the mixer is spending his summer trying to persuade the material suppliers to let him have a bigger quota than last year. The prospects for the coming season look somewhat better, particularly as regards superphosphate, with new plants coming into production. Prices on some materials show a tendency to increase, although, on the whole, fertilizer prices are still below the levels of other farm purchases.

Sulphate of Ammonia

There has been no slackening of demand for sulphate of ammonia and the current high production is sold well in advance. There is no general price level as producers and distributors are quoting from $30.00 to as high as $38.50 per ton, f.o.b. producing plants. May production of both by-product and synthetic material totaled over 87,000 tons. With the signing of the new wage contracts by coal miners and operators, a continued supply seems to be assured, but the rise in coal prices may bring a further rise in sulphate prices.

Nitrate of Soda

There has been no announcement as to how the Chilean output is to be allocated during 1947–1948. Final deliveries of this material for the season ended June 30, 1947 show that buyers got about 20 per cent less than had been allocated. Current arrivals of nitrate are taken immediately for top-dressing needs.

Ammonium Nitrate

Canadian producers of ammonium nitrate have raised prices from $57.00 to $62.75 per ton, f.o.b. works. Domestic material is still quoted at $48.50, f.o.b. works. The demand is several times greater than the maximum supply available.

Organic Materials

A few odd lots of packing house materials are finding their way into fertilizer production but on the whole these are now a feed problem only. Prices have firmed up and feed manufacturers are paying from $7.00 to $7.50 ($8.50 to $9.12 per unit N) for their materials with demand still active.

Phosphate Rock

There has been no let-up in the demand for phosphate rock and no prospects of any slackening during the coming months. Shipments are taking this material as fast as it can be produced and hence no stocks are accumulating at the mines. Exports during the late spring have shown a tendency to increase.

Superphosphate

Producers have written up a considerable amount of contract business for the coming season, which will take care of a large part of productive capacity. There has been no change in price on spot material when any is available for purchase.

Potash

By the beginning of the present 1947–48 season, most fertilizer manufacturers had placed their contracts for the year in order to have the advantage of the maximum discounts. Some potash producers have now contracted for their entire year's output. Shipments on current contracts have been going through recently without the usual transportation delays.

PHILADELPHIA

Scarcity of Materials Continues. Organics Show Price Increase from Feed Trade. Superphosphate Contracts Being Closed.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, July 21, 1947.

Most of the important fertilizer materials are very scarce and the price tendency is strongly upward. The demand for contracts exceeds the visible production capacity.

Sulphate of Ammonia.—The demand continues very strong. Producers' prices are generally from $33.00 to $35.00 at shipping point, with one shipper, however, said to be still billing at $30.00. On the other hand, resales are at very much higher prices. The production in May is said to have exceeded April by about 2,500 tons.

Nitrate of Soda.—The demand is still ahead of the supply, and current arrivals from Chile will not cover total requirements.

Castor Pomace.—No offerings or transactions reported.

Blood, Tankage, Bone.—Present market for these organics is much firmer, due principally to increased demand from the feeding trade. Tankage sold at $7.25 and $7.35 per unit of ammonia ($8.81 and $8.93 per unit N), with blood offering at $7.00 to $7.25, ($8.50 to $8.81 per unit N). Bone meal is in fair supply at increased prices.

Fish Scrap.—The catch is reported as satisfactory, but offerings are not quite so free as during the previous week. Sixty-five per cent meal was offered at $132.00 per ton in the West. Market is firm.

Phosphate Rock.—The demand is still steady and strong enough to take care of current production capacity. Quantity exported in April, 1947 was almost twice that in April, 1946.

Superphosphate.—Most business limited to contracts, and the demand is very active. with market tight. Easier future conditions are expected, however, due to greatly increased production facilities now under consideration.

Potash.—The demand continues for much more than the available capacity to supply. Inquiries for sulphate of potash are particularly numerous at present. Offerings have been received from Russian sources of potash material at prices much in excess of the domestic cost, and it is doubtful whether much, if any, business will be done in that direction. It is reported that in April we exported about 5,800 tons of muriate of potash, and imported almost 15,000 tons.

CHICAGO

Prices of Nitrogenous Tankage Seem High for General Fertilizer Use. Feed Market Reports Price Advances.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, July 19, 1947.

According to well-informed sources, it appears that at present prices nitrogenous organics are practically prohibitive in general mixtures. This, however, is contrary to the views of the producers, judging from sales made and continued active inquiry. This may be the "sixty-four dollar question" which the trade this fall and winter will answer.

A strong undertone has been ruling in the feed market, with reports of trading at advanced figures which are, of course, entirely too high for fertilizer purposes.

Louis Ware on European Trip

Louis Ware, president of International Minerals & Chemical Corporation, sailed from New York for Stockholm on July 5th to confer with leading users of phosphate rock in eight European countries with the view towards extending the export market for this vital agricultural product.

Mr. Ware's trip is intended to determine how International's products can aid in restoring Europe's agricultural economy through stimulating increased food production, which can be accomplished largely by means of greater utilization of fertilizers. Mr. Ware will visit Sweden, Norway, Denmark, The Netherlands, Belgium, Switzerland, France and Great Britain, and is expected to return to Chicago in September.

To handle its growing export business, the company has established a foreign sales agency in London under the name of International Minerals & Chemicals, Limited.

May Superphosphate Production Makes Record

According to the U. S. Bureau of Census, superphosphate production during May reached an all-time peak of 892,140 tons (basis 18 per cent A. P. A.), an increase of 3 per cent over April, and of 26 per cent over May, 1946.

Production of normal superphosphate fertilizer material in May was the highest for any month on record. May output of 803,501 tons was 5 per cent greater than April and 27 per cent greater than May of last year. Less

material was disposed of during May than in April. This decline together with the increase in production brought stocks of material at the end of the month to a level 17 per cent above April and 25 per cent above May, 1946.

Concentrated superphosphate production was at a high level during May. Although more material was produced in April, the record production month, this May's output was 25 per cent greater than the corresponding month of last year. May shipments also fell below April but were considerably above last year. Stocks on hand at the end of the month were slightly above April and were 35 per cent greater than a year ago.

Wet-base goods were produced at a slightly higher rate in May than in April, 1947 and May, 1946. Shipments declined for the third consecutive month. Stocks at the end of May were almost double the April figure and 50 per cent above May of last year.

	Normal 18% APA	Concentrated 45% APA	Base Goods 18% APA
Production	Tons	Tons	Tons
May, 1947.....	803,501	33,151	5,761
April, 1947.....	768,604	35,875	5,495
May, 1946.....	632,903	26,423	5,231
Shipments and Used in Producing Plants			
May, 1947.....	745,640	30,626	4,602
April, 1947.....	851,563	33,551	6,114
May, 1946.....	662,279	22,271	4,823
Stocks on Hand			
May 31, 1947....	539,246	57,524	3,184
April 30, 1947....	460,943	54,779	1,638
May 31, 1946....	431,448	42,465	2,207

New Edition of "Commercial Fertilizers"

The Blakiston Company, publishers, Philadelphia, Pa., have announced a new (4th) edition of "Commercial Fertilizers" by Gilbeart H. Collings, Professor of Soils at Clemson Agricultural College. This new volume includes many important changes in fertilizer practice that have developed in recent years, as well as improvements in fertilizer manufacture and new research in plant nutrition. An entirely new chapter on ammonium nitrate has been added.

The book covers the production of the principal fertilizer materials, the secondary fertilizer elements, principles underlying the use of fertilizers. It will be of value for classroom work, for the fertilizer manufacturer and for the solution of practical problems on the farm. The book contains 522 pages, with 160 illustrations and is priced at $4.50.

The International Superphosphate Manufacturers' Association

The International Superphosphate Manufacturers' Association held its Annual General Meeting at Eastbourne, England, recently, when about two hundred delegates and members of their families were present, representing Belgium, Denmark, Egypt, Finland, France, Holland, India, Italy, Algeria, Tunisia, Morocco, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, Australia and New Zealand.

Delegates were entertained by the Fertiliser Manufacturers' Association, Fisons Ltd., Rio Tinto Co., Ltd., Tharsis Sulphur and Copper Co. Ltd., and the West Norfolk Farmers' Manure & Chemical Co-operative

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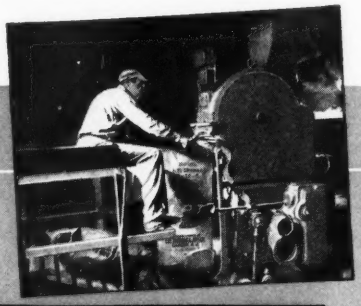

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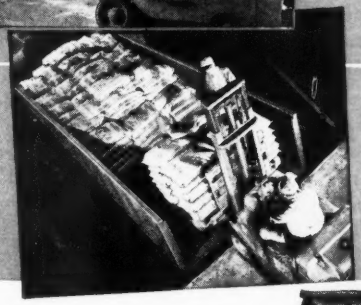

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This was the first meeting since the war at which ladies have been present, and beautiful weather and the hospitality enjoyed by the delegates combined to make this one of the most successful meetings ever held.

For the year 1947–48 the following officials were re-elected: A. Waller (Holland), President; R. Audouin (France), F. G. Clavering Fison (U. K.), H. Stevenius-Nielsen (Denmark), R. Standaert (Belgium), Vice-Presidents; R. M. Collins, Secretary.

F. Lavaste (France), P. Wonsild (Denmark) and N. P. Mathiasson (Sweden) were elected Honorary Vice-Presidents for life in recognition of their past services to the Association.

The Association has now moved to 14a, Great Marlborough Street, London W.1., and the Paris office of the Agricultural Committee is located at 139, Boulevard Haussmann, Paris (8e).

International Minerals Announces Executive Changes

James P. Margeson, Jr., was elected executive vice president of International Minerals & Chemical Corporation, and Edward D. McDougal, Jr., was elected corporation secretary and general counsel at a meeting of the Board of Directors held recently in New York, according to an announcement by Louis Ware, president.

Since 1942 Mr. Margeson has been vice president in charge of the mining and distribution of potash. He joined International Minerals & Chemical Corporation in 1940 as assistant to the president. During the war he supervised the construction and operation of plants which produced magnesium, potassium chlorate and fluorspar for the government. In his new capacity he will have such duties as are assigned by the president and will act for the president in his absence.

Mr. McDougal was elected to the office of corporation secretary to succeed John Homer Hunt, who has served in that capacity since 1936 and whose retirement from active business duties became effective July first, after 35 years of service with the corporation and predecessor companies.

Mr. McDougal has been a partner in the law firm of Sidley, Austin, Burgess & Harper since January 1931, except during the period between May, 1944 and September, 1946 when he served in the United States Naval Reserve, from which he was released to inactive duty with the rank of Captain. He was employed originally by the law firm in 1922, before graduating from law school. With the firm he has been engaged in the general practice of law, particularly in the field of corporation law.

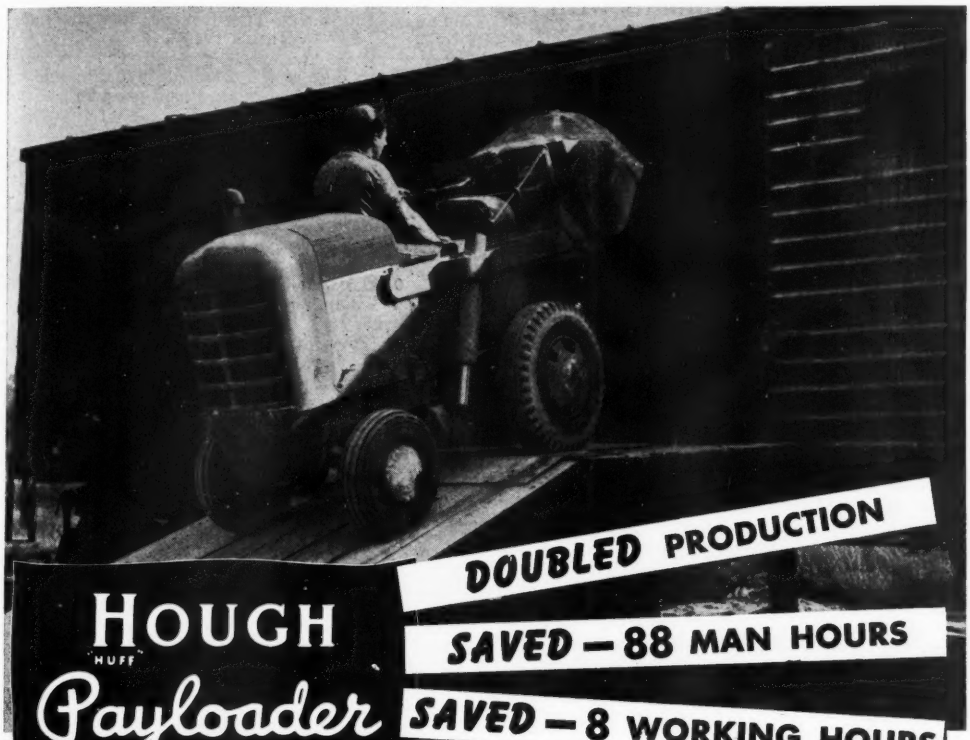
Mr. Ware also announced the appointment of A. Norman Into as general manager of the corporation's Potash Division. Mr. Into came with the corporation in 1942 and since that time has served as sales manager of the Potash Division.

Davison Publishes Fertilizer Manufacturing Manual

The Davison Chemical Corporation has published a Manual on Fertilizer Manufacture, for the use of fertilizer employees in supervisory positions and for those not too well technically trained who want to know more about fertilizer manufacturing procedures. This volume, of 126 pages, substantially bound in leather cloth, was prepared by Vincent Sanchelli, Director of Agricultural Research for the Davison Company.

In addition to a discussion of the principal plant food elements and their action in the soil, the manual gives practical instruction in the methods of formulating mixed fertilizers and base goods, ammoniation, etc. Other chapters deal with the superphosphates and other phosphate fertilizers, secondary elements, chemical reactions in fertilizer manufacture, computing fertilizer formulas. The book will be a valuable addition to the plant superintendent's library and of great help to every employee who is desirous of increasing his practical knowledge of the business.

The manual is priced at $4.00 per copy. Sales are being handled by the Fertilizer Department, Davison Chemical Corporation, 20 Hopkins Place, Baltimore 3, Md.



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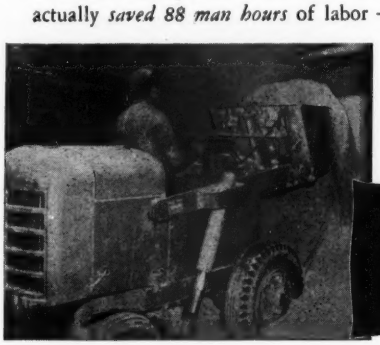

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Fertilizer Experiments with Tomatoes in Texas

By MYRON D. BRYANT

Tomato Investigations Laboratory, Franklin, Texas

PERFORMANCE of two varieties of tomatoes, Rutgers and Stokesdale, were tested under varied fertilizer treatments in 1946 at the Tomato Investigations Laboratory at New Baden, Tex. The soil was a loamy fine sand of the Bowie series with good surface drainage, but with an extensive amount of seepage from higher land nearby. This field had not been cultivated for several years and the organic content was good for this type of soil, but the fertility was low.

Yields in general were low for all treatments due to excess moisture in the soil during the growing season. The plants became wilted from the "wet-feet" condition and remained so for 10 days, but all plats seemed to suffer alike. While complete recovery was obtained, production was somewhat reduced.

This experiment deals with four series of tests: the proportions of nitrogen, phosphorus, potash, and rate of application. The check treatment was 600 pounds of 6–12–6 per acre. All fertilizer was applied in the drill before setting, except where otherwise indicated. Results are set forth in Table 1.

Tomatoes responded well to increased amounts of nitrogen from 0 to 12 per cent in the formulas. The treatment of this series giving the highest yield was where 600 pounds of 6–12–6 per acre were applied before setting, followed with 50 pounds of 32.5 per cent ammonium nitrate per acre applied one month after setting. The increase over that of the check is significant. All plats receiving fertilizers containing nitrogen produced significantly higher yields than plats which received fertilizers lacking nitrogen.

Phosphorus has long been considered highly important for tomatoes, and its use has been clearly demonstrated here. A 6–6–6 fertilizer more than doubled the yield from a 6–0–6 formula. The complete fertilizer was significantly higher than superphosphate alone, when applied in equal amounts to different plats. A 600-pound application of superphosphate per acre produced a higher yield than did nitrogen and potash without phosphorus, but did not equal that of any complete fertilizer.

Potash seemed to be the least needed of the three elements. Gradual increases in yields resulted from increased percentage of potash from 0 to 12 per cent in the formula. While

TABLE 1.
TOMATO FERTILIZER TEST YIELDS, NEW BADEN, TEXAS, 1946

Rate (lbs. per acre)	Type of fertilizer	Pounds of marketable fruit per acre*		
	Nitrogen Series	Rutgers	Stokesdale	Average
600	0–12–6	4,144	6,050	5,097
600	6–12–6 (check)	6,489	9,998	8,244
600	9–12–6	7,366	9,706	8,536
600	12–12–6	8,357	11,306	9,832
600	6–12–6 plus 50 lbs. 32.5% ammonium nitrate	9,185	11,525	10,345
	Phosphorous Series			
600	6–0–6	2,802	5,237	4,020
600	6–6–6	7,052	10,255	8,654
600	6–9–6	8,307	10,765	9,536
600	6–12–6 (check)	6,489	9,998	8,244
600	6–18–6	9,253	11,355	10,304
600	0–18–0 (superphosphate)	4,761	6,874	5,818
	Potash Series			
600	6–12–0	5,736	10,440	8,088
600	6–12–6 (check)	6,489	9,998	8,244
600	6–12–9	7,657	10,463	9,060
600	6–12–12	8,079	11,877	9,978
	Rate Series			
0	0–0–0	1,581	4,271	2,926
400	6–12–6	7,071	10,414	8,742
600	6–12–6 (check)	6,489	9,998	8,244
800	6–12–6	6,961	10,939	8,950
1000	6–12–6	7,650	10,969	9,310
400 plus 200—one month later	6–12–6	9,423	12,081	10,752
600	6–9–6	8,307	10,765	9,536
600	12–18–12	8,183	11,540	9,862

* A difference of 96 pounds per acre for significance.

it is doubtful that large amounts of potash would prove profitable, it is certainly needed to form a balanced fertilizer for tomatoes.

When the season is rainy, large amounts of fertilizer applied before setting is not recommended. Where a moderate amount was applied before setting and another application is made at the time the first cluster was well set, highly significant yields over any other fertilizer treatment were obtained. Yields from plats receiving 1000 pounds of 6–12–6 per acre were not significantly higher than those of plats receiving only 400 pounds, all fertilizers being applied in the furrow before setting. Heavy rains may carry much of the mineral content of the fertilizer out of the field before the plants have reached maturity, with the results that the third to the fifth and sixth clusters of fruit are small and undeveolped. This is especially true in the case of nitrogen. Successive applications provide ample food elements in reach of the plant's roots throughout the fruiting season, producing large, firm fruit that look and ship well until midsummer.

Fertilizing Legumes in California

Use of phosphorus, potassium, and sulphur as fertilizers for legumes has been studied in about 150 exploratory trials in 20 representative California counties. The gratifying results have been summarized by John P. Conrad, agronomist in the California Agricultural Experiment Station.

Until recently the possible magnitude of the increases in yields of legumes from such fertilizer practices had not been recognized. Increased yields were marked for non-legume crops which followed the legumes.

In the tests made, treble superphosphate, muriate of potash, and gypsum were applied singly and in all combinations. Some legumes showed increased growth from 50 to 1,000 per cent on range, hay, grain, and pasture lands. These pioneering results were from gypsum and phosphorus applied singly, or in combination. Further studies are being made as to the possibilities of responses from potash.

The increases of non-legumes such as grasses, cereal hay, and thrashed grain following the fertilized legumes varied from 38 per cent to 107 per cent.

Because of the many varied agricultural conditions in California, fertilizer practices differ considerably from one section to another.

N. F. A. ACTIVITIES

(Continued from page 10)

ington for a specific task and were unfamiliar with many phases of Washington sources of information.

On the third subject, Actual Savings to Industry in which our Association has participated: Again, there are so many activities that it is possible to cover only a few. The work with the Official Agricultural Chemists Association brought about uniform methods of analyses which have been of great value to Industry. Through the close cooperation with this body, our Chemical Control Committee was able to effect a change in analytical methods to determine the available phosphoric acid percentage after ammoniation of superphosphate became general throughout the Industry. Working with the Association of Official Agricultural Chemists, they revised their stand method of analysis after tests sponsored by our agronomists proved that a higher availability of phosphoric acid was carried in ammoniated superphosphate than the previous analytical method disclosed.

The Traffic Committee

The Traffic Committee and staff of the Association, guided by Technical Assistant Fred S. Lodge, have diligently opposed freight rate increases which, if unopposed, would have materially increased the cost of fertilizers, which cost, of necessity, would have been added to the farmers' fertilizer bills. In order to illustrate what some of these savings have amounted to, and the importance of this service to our Industry and to Agriculture, a few specific cases are of interest.

During the period 1937 through 1939, the rail carriers announced substantial increases in rates on certain commodities, particularly

bone products, phosphate rock, and all fertilizer and fertilizer materials in and between certain territories. Over and above these increases, the carriers, in case Ex parte 115, attempted to increase all freight rates 15 per cent, thereby pyramiding increases on certain fertilizer shipments over 30 per cent.

The National Fertilizer Association, through its Traffic Committee and Commerce Council in Washington, protested these double increases and succeeded in having the increased rate suspended, pending action by I. C. C. As a result of these suspensions and the final decision of the Commission, substantial savings in freight rates were obtained. Some of these and other subsequent cases are worthy of listing:

The bone case I. & S. Docket 4335, annual savings to industry, estimated.....	$36,000.00
Phosphate rock I. & S. Docket 4365, increases suspended for 9½ months, and only a fraction allowed in final decision. Savings estimated during 9½ months.	360,000.00
Annual savings to Industry thereafter estimated.....	300,000.00
Interterritorial case I. C. C. 19890, savings to Industry during suspension period estimated.....	260,000.00
Annual savings thereafter estimated.....	117,900.00
Central Freight Association case savings to Industry during suspension period estimated.....	400,000.00
Annual savings thereafter estimated.....	250,000.00

It might be safely stated that fully one million dollars were saved in one year by the successful opposition of our Association to these proposed freight increases, and fully half of this amount every year since. This sort of work is never completed, for during the last few months, due to the alertness and diligence of our staff, an error in interpretation of rates on phosphate rock was disclosed and successfully brought to a conclusion which results in a saving to our Industry, and ultimately to the farmer, of $120,000.00 per annum.

It is because of such effort along many lines that prices for fertilizers have increased less than any other commodity the farmer buys.

A Capable Staff

This is a rather brief review, but in it I have attempted to outline some phases of the educational effort of our Association and service rendered American farmers, with the hope that this will stimulate increased support for this type of endeavor.

One must not overlook the fact, however, that behind every project some member of our staff is rendering yeoman's service.

It is not my purpose to eulogize individuals in our Washington office but since some of the accomplishments of our Association have been described, it is fitting that I pay tribute to the splendid work of our Secretary, D. S. Murph, and Technical Assistant Fred S. Lodge, who have contributed much to the success of every activity of the Association.

Much credit is also due Robert H. Engle of our Agronomy Staff for the production of our motion pictures and slides and in the assistance rendered in the development of pamphlet material covering the field of agronomy.

Also, I commend the work of W. E. Chace, a rather recent member of our organization, who has, working in close cooperation with our energetic public relations committee, effectively assisted in the development of a well balanced public relations program.

I know that you, as well as your Board of Directors, are deeply gratified with the manner in which our new President, Maurice H. Lockwood, has assumed his responsibilities as chief executive of our Association. With his practical as well as scientific background, we can face the future with assurance under his leadership.

In closing, I desire to assure you that I realize I have discussed no detail of our Association activities or of our Industry with which you are unfamiliar. We are, however, prone to forget or to take for granted that the progress, so apparent, has been occasioned by the vision and diligence of the personnel in our Association, ably supported by Industry. With the continued splendid cooperation with Government and State scientists and agronomists and County Agents, progress will continue.

Our ultimate objective is: the profitable use of fertilizers on every farm in the United States, and with proper teamwork this goal can be achieved.

Top-dress Meadows for Better Fall Feed

Top-dress the meadowland that has just been cut to be sure of fall feed or a better rowen or aftermath crop, Lester H. Smith, Vermont agronomist advises farmers. On moist soils a good response will be obtained from top-dressing this time of year, Smith adds.

On meadows that are mostly clover or alfalfa, 500 to 600 pounds of an 0–14–14 is a good fertilizer to use. If the legume stand is 50 per cent or less, a 5–10–10 or 4–12–16 applied at the rate of 500 pounds will give good results. On grass sods use a 7–7–7, 5–10–10 or 4–12–8 at 500 pounds per acre, he recommends.

It is possible that some dry weather is in store for Vermont farmers, Smith warns. When a crop is well supplied with plant food, however, it is much better able to grow under adverse weather conditions.

FERTILIZER APPLICATION

(Continued from page 8)

injury. This is especially true on light soils of low organic matter content and if the fertilizer is not mixed to any great extent, if plantings are made soon after applying fertilizer, or where large amounts of fertilizer are applied. In general, the practice may be more injurious than other methods of fertilizer placement and should, therefore, be avoided.

3. *Band placement.* This is perhaps the most effective way of applying small amounts of fertilizer (under 800 lb. per acre) for row crops. It is also highly useful for larger amounts of fertilizer on acid soils or soils of high phosphorus fixing capacity. Whenever large amounts of fertilizers are used (over 800 lb. per acre) and the pH of the soil can be raised to satisfactory levels, it will usually pay to do so and to mix fertilizer and soil.

Placement in bands, while making phosphorus less subject to fixation, may limit nutrient uptake by having fertilizer positionally unavailable during dry weather. Attempts to eliminate this factor have included use of one high and one low band. Another method has included placement of fertilizer in bands about 7 inches apart and about 4 to 5 inches deep, the fertilizer being so placed with a grain drill. A third method has added a band of fertilizer at the plow sole by dropping fertilizer behind the plow. The hi-lo placement has been proven to offer little if anything over conventional band placement. However, deep band placement has been definitely worthwhile, especially when combined with some fertilizer close to the surface. Its greatest fault is in slowness of application and is therefore usually unpopular with farmers. The deep and close bands as produced with a grain drill have been especially useful for such crops as corn.

4. *Plowing under fertilizer.* One of the simplest and cheapest ways of applying fertilizer is to spread it on the surface and plow it under. It is a very effective method of applying large amounts of fertilizer. Fertilizer so applied has the advantage of being positionally available during dry weather and there is little danger from fertilizer burning. It is not too satisfactory on soils of low pH and/or having excessive phosphate fixing capacity. Likewise its effectiveness is reduced on extremely light soils. However, experiments have proven its usefulness on sandy loam soils, sandy gravelly soils and other soils having only moderate retentive powers.

A variation of plowing under fertilizer has shown great promise. Fertilizer is applied to established cover crops some time before plowing is to take place. Some of the fertilizer is absorbed by the cover crop and inorganic nutrients are converted to organic forms. The cover crop releases such nutrients slowly at some time after it is plowed under.

The fertilization of cover crops and subsequent plowing under is still in an experimental stage but already holds great promise. It has proven to be effective with fall fertilization and early plowing for spring peas. It holds great promise in being an efficient way of adding fertilizer for light soils. On excessively light soils, it may be necessary to make several small applications of fertilizer

to the cover crop at different intervals in order to reduce losses.

5. *Applying fertilizer after plowing.* Several variations of this method are being used. The broadcast application after plowing and subsequent disking before planting can be used for fairly large amounts of fertilizer. However, it offers less advantages than plowing under fertilizer because of increased spreading costs (drawing equipment over plowed land), possibility of fertilizer burning and unavailability of fertilizer if it is not worked deeply in the soil. Fertilizer applied on the surface of the row after seed has been planted may give very poor results in some seasons and therefore is not recommended.

Side dressings of fertilizer, either in a dry or liquid form, have been used with considerable success, especially on light soils. Generally plants absorb only a small quantity of fertilizer in early stages, the bulk of fertilizer being removed as the plants are larger. Side dressings of fertilizer help to meet this delayed demand. Phosphorus in ordinary mixed fertilizers does not tend to move downward rapidly and the nitrogen and potash as side dressing may be unavailable unless rain comes soon afterwards. Use of liquid fertilizers as side dressings avoids this possibility and will be worthwhile in many operations. Because of the effectiveness of liquid fertilizers, less fertilizer than used in dry form will often give as good results.

6. *Combination of methods.* It often is worthwhile to combine two or more of these methods. For example, very high yields have been obtained by supplying a small amount of fertilizer near the surface either as a starter, or in bands along with heavy application plowed under. Another worthwhile procedure would employ a small amount of fertilizer in bands on either side of the row and subsequent dry or wet side dressings.

Several procedures combined may be more effective but in general add to the cost of distributing fertilizer. The decision as to validity of extra costs depends in part on the value of the crop grown and soil conditions.

To summarize, the effectiveness of fertilizers is often influenced by the manner in which it is applied or as it is placed. No one type of placement is best for all soils and all conditions. There are several excellent methods of fertilizer placement which will avoid positional and chemical unavailability and still not harm plant roots. Under certain circumstances it may be advisable to combine one or more of these methods. A general outline as to the type of placement for various conditions is given in Table 1.

TABLE I.

GENERALIZED PROGRAM FOR PLACEMENT OF FERTILIZERS UNDER VARIOUS CONDITIONS

Soil	Fert. Application	Type of Placement
Light soils or those subject to excessive leaching	Small	(1) Starter amounts plus small side dressings
	Large	(1) Starter amounts plus side dressings (2) Plowing under all the superphosphate plus small amounts of nitrogen and potash; remainder of nitrogen and potash as side dressings (3) Fertilization of cover crop, applying only a portion of fertilizer at any one time
Medium and heavy soils or soils subject to only mod erate leaching	Small	(1) Band placement on either side of row*
	Large	(1) On soils of pH greater than 6.0 and not fixing large amounts of phosphorus, plowing under of fertilizer. The fertilizer may be applied to cover crop some time before plowing (2) On soils of pH less than 6.0 and fixing large amounts of phosphorus, band applications either close and deep as with grain drill or at the bottom of plow furrow. May be well to combine these with small amounts amounts applied as starter

*Two inches either side of seed and one inch below seed level.

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